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10/052,020	01/17/2002	Nathan D. Cahill	83507DMW	1225

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EXAMINER	
QUIETT, CARRAMAH J	

ART UNIT	PAPER NUMBER
2612	

DATE MAILED: 03/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

ΩM

Office Action Summary	Application No.	Applicant(s)
	10/052,020	CAHILL ET AL.
	Examiner	Art Unit
	Carramah J. Quiett	2612

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 January 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01/17/02* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *02072005*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS), filed on 01/17/2002, has been placed in the application file, and the information referred to therein has been considered as to the merits.

Claim Objections

2. Claim 13 is objected to because of the following informalities: In claim 13, the limitation beginning with lettering "(c)" should be "(b)". Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 1-5, 8, 10, 13-16, 18- 20, and 22** are rejected under 35 U.S.C. 102(b) as being anticipated by Carlson (U.S. Pat. #4,554,585).

For **claim 1**, Carlson teaches an electronic imaging system (fig. 1, 100, 110, 108) for capturing an image of a scene (col. 2, lines 57-62), said imaging system comprising:

(a) an optical system (fig. 1, 100) for producing an optical image of the scene (col. 2, line 63 – col. 3, line 10);

(b) an imaging sensor (solid-state imager, col. 2, lines 63-65) having a surface in optical communication (col. 2, line 66 – col. 3, line 2) with the optical system; and

(c) a plurality of imaging elements (fig. 2a) distributed on the surface of the imaging sensor (col. 4, lines 13-23) for converting the optical image into a corresponding output signal (col. 3, lines 4-7), said imaging elements located according to a distribution representable by a nonlinear function in which the relative density of the distributed imaging elements is greater toward the center of the sensor (col. 4, lines 28-33), wherein the distribution provides physical coordinates for each of the imaging elements corresponding to a projection of the scene onto a non-planar surface, thereby compensating for perspective distortion of the scene onto the non-planar surface (col. 4, lines 24-28).

For **claim 2**, Carlson further discloses a system wherein the non-planar surface is inherently a cylinder. This is inherent because in col. 4, lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern.

For **claim 3**, Carlson further discloses a system wherein the non-planar surface is a sphere. This is inherent because in col. 4, lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern.

For **claim 4**, Carlson further discloses an optical system that includes a lens (fig. 3, 304) and the axis of rotation of the cylinder intersects a nodal point of the lens. As stated before, it is inherent that Carlson's non-planar surface is a cylinder because in col. 4, lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern. As illustrated in fig. 3, the center of the cylinder is located at a nodal point of the lens because the imager is located along the optical axis of the lens

(col. 5, lines 13-19). The imager senses light from the lens via a low-pass filter (col. 5, lines 26-29).

For **claim 5**, Carlson further discloses a system wherein the optical system includes a lens and the center of the sphere is located at a nodal point of the lens. As stated before, it is inherent that Carlson's non-planar surface is a sphere because in col. 4, lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern. As illustrated in fig. 3, the center of the sphere is located at a nodal point of the lens because the imager is located along the optical axis of the lens (col. 5, lines 13-19). The imager senses light from the lens via a low-pass filter (col. 5, lines 26-29).

For **claim 8**, Carlson further discloses a system wherein the imaging sensor is a charge-coupled device (col. 2, lines 63-65).

For **claim 10**, Carlson further discloses a system wherein the output signal includes data from a plurality of images (col. 2, lines 19-33).

For **claim 13**, Carlson teaches an electronic image sensor (solid-state imager, col. 2, lines 63-65) for use in an electronic imaging system (fig. 1, 100, 110, 108) for capturing an optical image of a scene (col. 2, lines 57-62); said sensor comprising:

(a) a surface in optical communication with the scene (col. 2, line 63 – col. 3, line 10); and

(c) a plurality of imaging elements (fig. 2a) distributed on the surface of the sensor (col. 4, lines 13-23) for converting the optical image into a corresponding output signal (col. 3, lines 4-7), said imaging elements located on the surface according to a distribution representable by a nonlinear function in which the relative density of the distributed imaging elements is greater

toward the center of the sensor (col. 4, lines 28-33), wherein the distribution provides physical coordinates for each of the imaging elements corresponding to a projection of the scene onto a non-planar surface, thereby compensating for perspective distortion of the scene onto the non-planar surface (col. 4, lines 24-28).

Regarding **claim 14**, this claim is a claim corresponding to the claim 2. Therefore, claim 14 is analyzed and rejected as previously discussed with respect to claim 2.

Regarding **claim 15**, this claim is a claim corresponding to the claim 3. Therefore, claim 15 is analyzed and rejected as previously discussed with respect to claim 3.

Regarding **claim 16**, this claim is a claim corresponding to the claim 8. Therefore, claim 16 is analyzed and rejected as previously discussed with respect to claim 8.

For **claim 18**, Carlson discloses a digital camera (fig. 1, 100, 110, 108) containing the image sensor (solid-state imager, col. 2, lines 63-65) of claim 13. In col. 3 line 47, the image signal processor of Carlson's camera digital.

For **claim 19**, Carlson discloses in an electronic imaging system (fig. 1, 100, 110, 108) including an image sensor (solid-state imager, col. 2, lines 63-65) for converting an optical image into an output signal (col. 3, lines 4-7), the improvement wherein the image sensor comprises a plurality of imaging elements (fig. 2a) distributed on a surface of the sensor (col. 3, lines 4-7) for converting the optical image into a corresponding output signal (col. 3, lines 4-7); said imaging elements located on the surface according to a distribution representable by a nonlinear function in which the relative density of the distributed imaging elements is greater toward the center of the sensor (col. 4, lines 28-33), thereby compensating for perspective distortion of the scene onto a non-planar surface (col. 4, lines 24-28).

Regarding **claim 20**, this claim is a claim corresponding to the claim 8. Therefore, claim 20 is analyzed and rejected as previously discussed with respect to claim 8.

For **claim 22**, Carlson inherently discloses a system including the improvement wherein the image sensor (solid-state imager, col. 2, lines 63-65) is a component in a digital camera (fig. 1, refs. 100, 110, 108). In col. 3, line 47, Carlson teaches that the image signal processor of the camera is digital.

Claim Rejections - 35 USC § 103

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. **Claims 6-7** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carlson (U.S. Pat. #4,554,585) in view of Hsieh et al. (U.S. Pat. #6,798,923).

For **claim 6**, Carlson does not specifically disclose a system wherein the radius of the cylinder is a function of a focal length of the optical system. However, in col. 4 lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern. Additionally, in figure 2a, Carlson illustrates an image sensor where there are radial changes with respect to the high/low resolution periphery (col. 4, lines 24-42). The center of the cylindrical imager, which senses light from the lens via a low-pass filter (col. 5, lines 26-29), is located along the optical axis of the lens as illustrated in fig. 3 (col. 5, lines 13-19). In the same field of endeavor, Hsieh explains how to remove the effects of panoramic distortion of images projected on a cylinder (col. 3, line 65 – col. 4, line 40) by utilizing equations (1) – (4) to obtain coordinates for the corresponding pixel of the image plane in the cylindrical map. Since Hsieh states that the radius is equal to the focal length, the focal length will change with respect to the radius. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to implement a system wherein the radius of the cylinder is a function of a focal length of the optical system in order to permit a predetermined mapping of the image onto the sensor.

For **claim 7**, Carlson does not specifically disclose a system wherein the radius of the sphere is a function of a focal length of the optical system. However, in col. 4 lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern. Additionally, in figure 2a, Carlson illustrates an image sensor where the radius changes with respect to the high/low resolution periphery (col. 4, lines 24-42). The center of the spherical imager, which senses light from the lens via a low-pass filter (col. 5, lines 26-29), is located along the optical axis of the lens as illustrated in fig. 3 (col.

5, lines 13-19). In the same field of endeavor, Hsieh explains how to remove the effects of panoramic distortion of images projected on a sphere (col. 3, line 65 – col. 4, line 40). Although, Hsieh gives an example of the cylindrical geometry, Carlson utilizes polar coordinates as explained in claim 3. Since Hsieh states that the radius is equal to the focal length, the focal length will change with respect to the radius. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to implement a system wherein the radius of the sphere is a function of a focal length of the optical system in order to permit a predetermined mapping of the image onto the sensor.

8. **Claims 9, 17, and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carlson (U.S. Pat. #4,554,585)

For **claim 9**, Carlson does not specifically disclose a system wherein the imaging sensor is a CMOS device. However, in col. 2, lines 63-64, Carlson teaches that his imaging system includes a solid-state imager. Examiner takes Official Notice that it is well known in the art for a CMOS device to be a type of solid-state imager. It would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to provide a system wherein the imaging sensor is a CMOS device in order to provide low-power consumption and to allow processing circuits to be integrated on the same substrate.

Regarding **claims 17 and 21**, both of these claims are claims corresponding to the claim 9. Therefore, claims 17 and 21 are analyzed and rejected as previously discussed with respect to claims 9.

9. **Claims 11-12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carlson (U.S. Pat. #4,554,585) in view of Ribera et al. (U.S. Pat. # 6,603,503).

For **claim 11**, Carlson discloses a system with a moveable television camera that produces a video signal, which is coupled to an image signal processor. Carlson's image signal processor, which analyzes the image defined by the video signal to determine the exact whereabouts of a particular object in field of view, can inherently operate directly on the output signal without having to warp the image data (col. 3, lines 33-46). However, Carlson does not teach a system including a processor for combining the images into a composite image.

In the same field of endeavor, Ribera discloses a system including a processor (Ribera, fig. 4, ref. 10) for combining the images into a composite image, thereby the processor can operate directly on the output signal without having to warp the image data (Ribera, col. 6, lines 10-21 and col. 4, lines 51-55). Similar to Ribera, Carlson's invention is related to wide view images (Carlson, col. 2, line 67 – col. 3, line 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to implement a system including a processor for combining the images into a composite image, thereby the processor can operate directly on the output signal without having to warp the image data in order to display panoramic images over a substantially 360 degree by 360 degree range of angles (Ribera, col. 1, lines 36-39).

For **claim 12**, Carlson does not further disclose a system including a projector for projecting the composite image onto a planar surface. However, Ribera further discloses a system including a projector (Ribera, fig. 4, ref. 20) for projecting the composite image onto a planar surface (Ribera, col. 6, lines 10-21). Similar to Ribera, Carlson's invention is related to panoramic/wide view images (Carlson, col. 2, line 67 – col. 3, line 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to

implement a system including a projector for projecting the composite image onto a planar surface in order to display panoramic images over a substantially 360 degree by 360 degree range of angles (Ribera, col. 1, lines 36-39).

10. **Claims 23-27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Carlson (U.S. Pat. #4,554,585) in view of Huang et al. ("Panoramic Stereo imaging System with Automatic Disparity Warping and Seaming," Graphical Models and image Processing, Vol. 60, No. 3, May 1998, pp. 196-208.)

For **claim 23**, Carlson teaches a method (fig. 1, 100, 110, 108) comprising: (a) generating the source digital images from an imaging source having imaging elements distributed so as to compensate for perspective distortion of the scene onto a non-planar surface (col. 2, lines 63-65; col. 3, lines 4-7 and 47; col. 4, lines 28-33). This claim differs from Carlson in that he does not teach a method of generating a composite digital image from at least two source digital images, said method comprising:

(b) combining the source digital images to form a composite digital image.

In the same field of endeavor, Huang teaches a method of generating a composite digital image from at least two source digital images (page 197, section 3.1, paragraph 1), said method comprising: (b) combining the source digital images to form a composite digital image (page 200, section 3.5). Additionally, Huang's panoramic stereo imaging system inherently has an imaging sensor because his system includes two cameras for the left-eye and the right-eye (page 197, section 3.1, paragraph 2). This system generates focused images by selecting the correctly focused image for each sensor (pages 197-198, section 3.2, paragraphs 1-2). Please see figs. 5-6

and read pages 199-200, section 3.4, paragraphs 1-2. Similar to Huang, Carlson discloses an imaging system for image warping/ blurring improvements (Carlson, Abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to provide a method of generating a composite digital image from at least two source digital images in order to provide 360° panoramic stereo images (Huang, section 2, page 197, paragraphs 2-4).

For **claim 24**, Carlson, as modified by Huang, further discloses a system including a projector for projecting the composite image onto a planar surface. On pages 204-207, Huang explains and illustrates the experimental results of the panoramic stereo imaging system. He demonstrates how the image distortion correction of the composite image is projected onto a planar surface. It would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to provide a method of including a projector for projecting the composite image onto a planar surface in order to provide 360° panoramic stereo images (Huang, section 2, page 197, paragraphs 2-4).

For **claim 25**, Carlson does not teach a method wherein the two source digital images overlap in overlapping pixel regions. Huang teaches a method wherein the two source digital images overlap in overlapping pixel regions (Huang, page 207, section 5 – Conclusion). It would have been obvious to one of ordinary skill in the art at the time the invention was made for Carlson to provide a method wherein the two source digital images overlap in overlapping pixel regions in order to provide 360° panoramic stereo images (Huang, section 2, page 197, paragraphs 2-4).

For **claim 26**, Carlson, as modified by Huang, further discloses a method wherein the non-planar surface is a cylinder. In col. 4 lines 28-33, Carlson states that the discrete picture

elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern. It is well known in the art for coordinates of a cylinder to be known as polar-coordinates. Also, please read Huang, pages 199-200, section 3.4, paragraphs 1-2.

For **claim 27**, Carlson, as modified by, Huang further discloses a system wherein the non-planar surface is a sphere. In col. 4 lines 28-33, Carlson states that the discrete picture elements 200 are symmetrically disposed about the center of a polar-coordinate spatial distribution pattern. It is well known in the art for coordinates of a sphere to be known as polar-coordinates. In the disclosure of Huang, 3-D cameras are utilized in the panoramic stereo imaging system. Although he uses a cylindrical surface to describe his panoramic stereo imaging system, Huang makes readers aware of the need for image distortion correction for images at the proper positions of a sphere as well as a cylinder.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carramah J. Quiett whose telephone number is (703) 305-0566. The examiner can normally be reached on 8:00-5:00 M-F. Beginning March 2005, the examiner's telephone number will be changed to (571) 272-7316.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy Garber can be reached on (703) 305-4929. Beginning March 22, 2005, the supervisor's telephone number will be changed to (571) 272-7308. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

C.J.Q.
March 7, 2005

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